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Vehicle Control Unit (VCU) for the HMMWV

Report Documentation Page

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Background of HMMWV Starting Problems

- **Protective Control Box (PCB)**
  - **25,000** Units Fail **Every** Year
- **Glow Plug Failures Due to Stacking**
  - Repeatedly Turning Starter Switch Lengthens Pre-Glow Time – **This Burns out Glow Plugs**
- **Results:**
  - **Truck Doesn't Start**
  - **1/3 of Fleet Down at any Given Time!!**

Protective Control Box (PCB) : The Main Problem

- **Most Failed Item** in the Army's Inventory:
  - **25,000** PCBs **Failed** Every Year ($150/Box)
- **PCB Failures Caused:**
  - **480,000** Glow Plugs to Fail Every Year ($4.50/Plug)
  - **72,000** Glow Plug Controllers **(GPC)** to be Replaced Every Year ($45/Controller)

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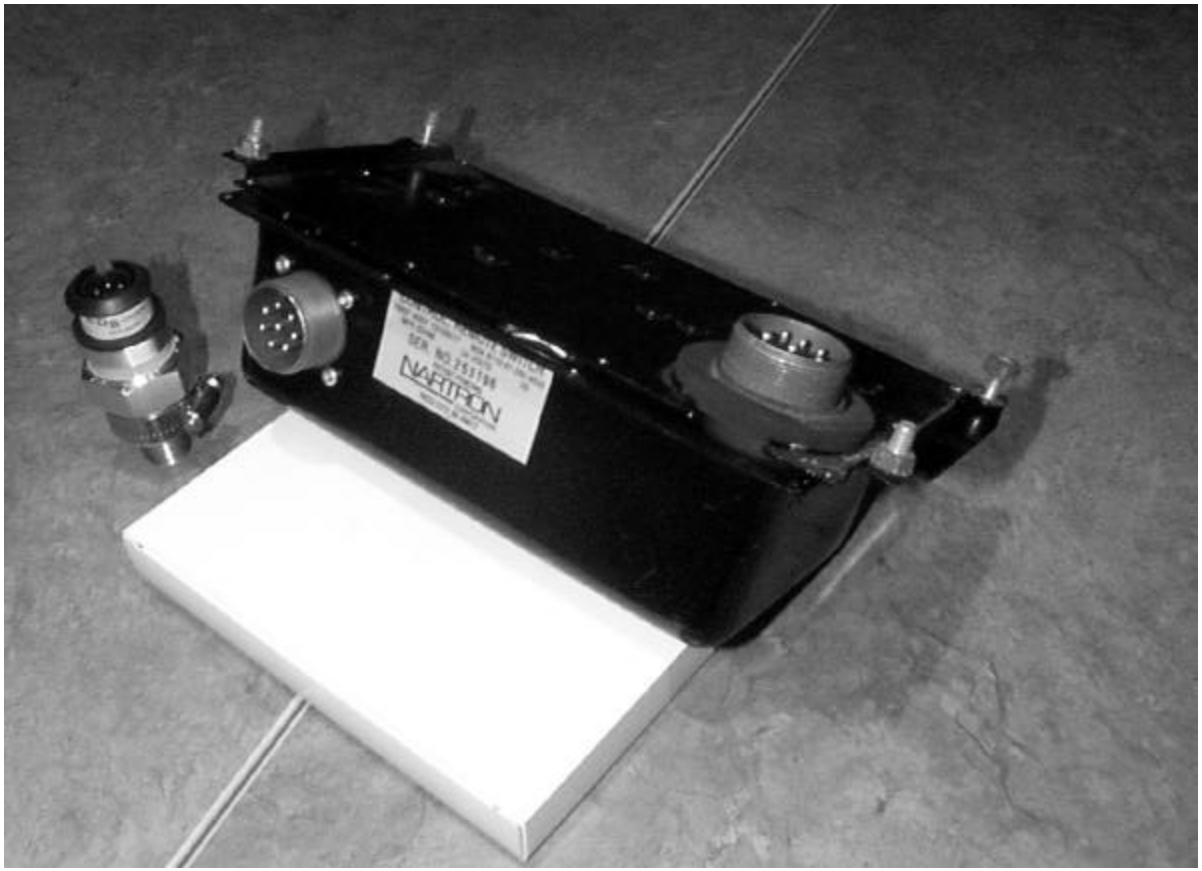
Obsolete PCB & GPC



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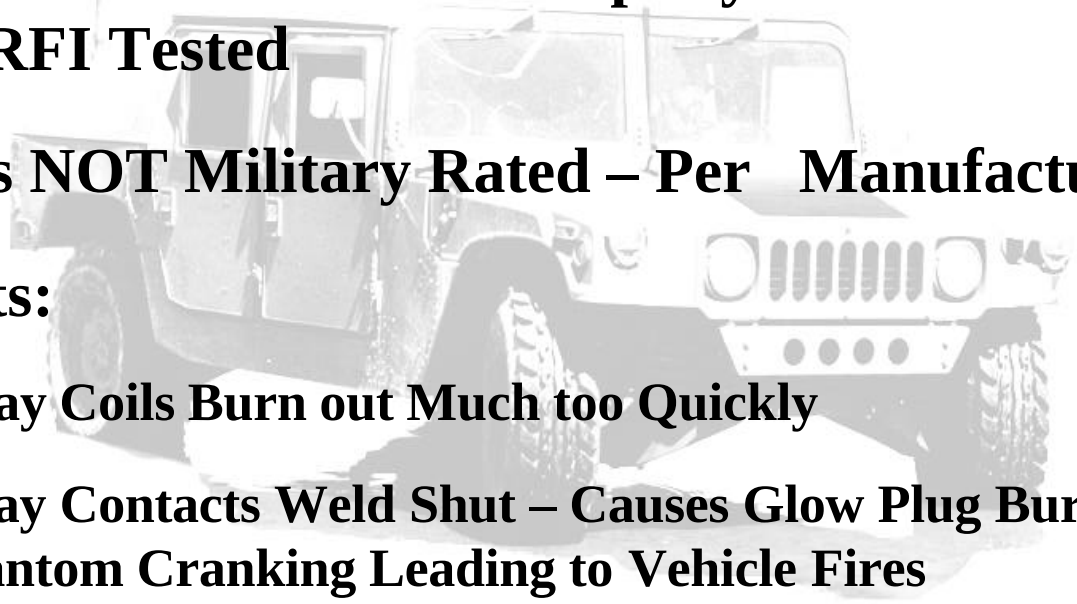
Failure Causes Identified



- **Some PCB Versions Not Properly Water-Sealed, Nor EMI-RFI Tested**
- **Relays NOT Military Rated – Per Manufacturer**
- **Results:**
  - **Relay Coils Burn out Much too Quickly**
  - **Relay Contacts Weld Shut – Causes Glow Plug Burn-out and Phantom Cranking Leading to Vehicle Fires**

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HMMWV Fire at Ft. Stewart, GA.

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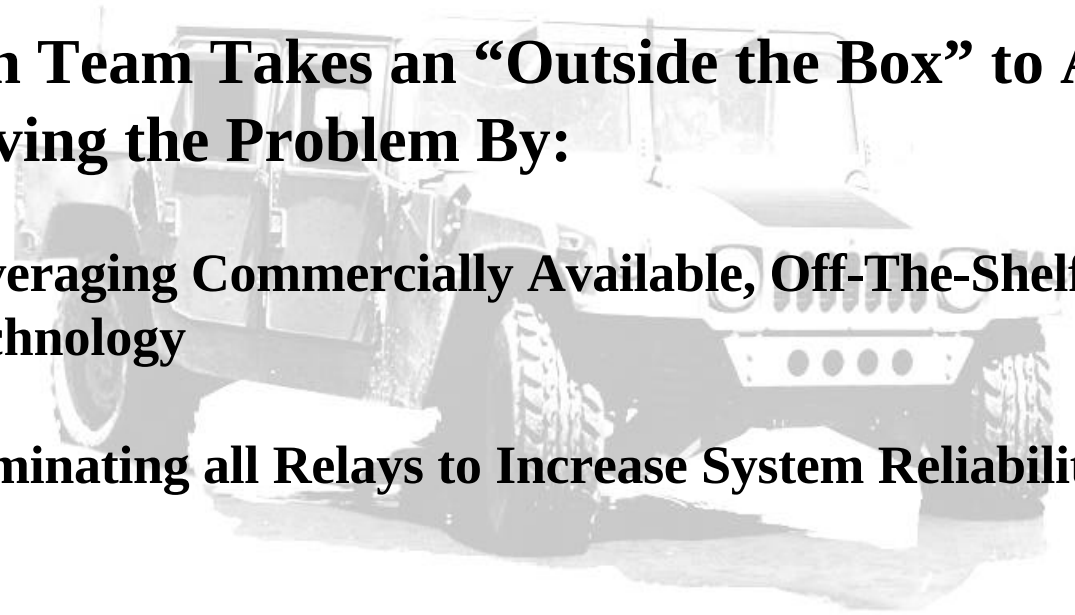
PCB - Interior View

Approach Taken to Solve the Problem



- **Design Team Takes an "Outside the Box" to Approach to Solving the Problem By:**
  - **Leveraging Commercially Available, Off-The-Shelf (COTS) Technology**
  - **Eliminating all Relays to Increase System Reliability**

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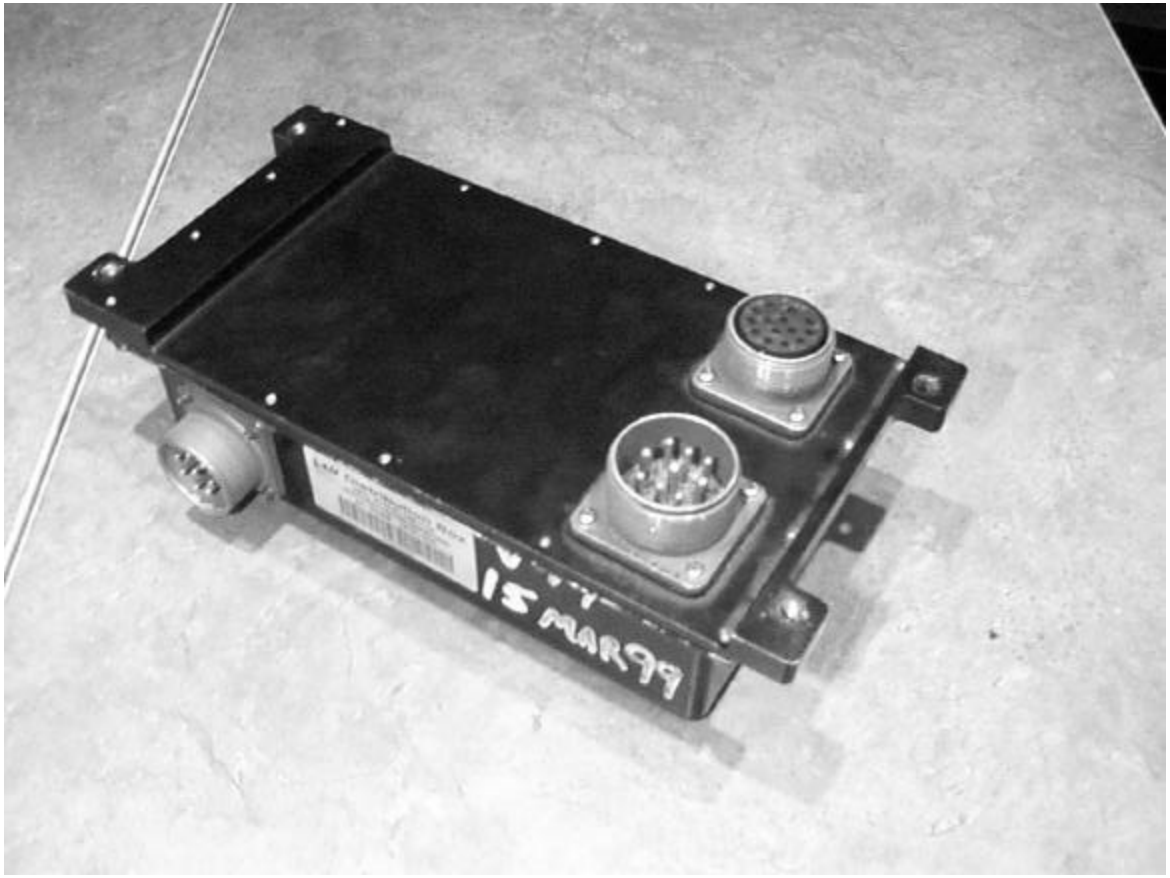
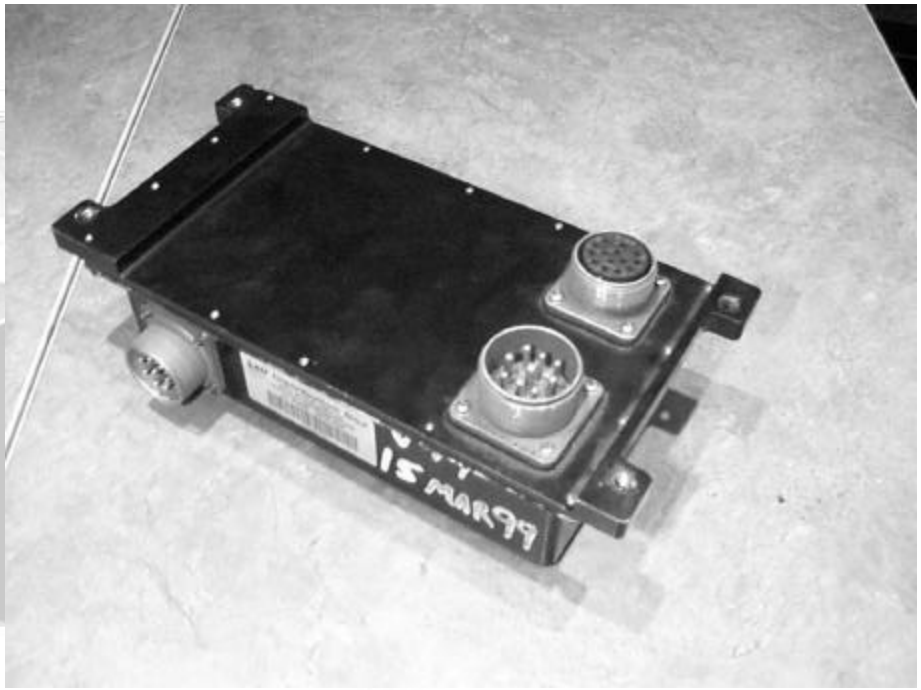
Enter The VCU



Vehicle Control Unit (VCU) for the HMMWV

- **VCU Upgrades Improve Fleet Readiness by +25%:**
  - **Increase in Starting System Reliability**
  - **Reduced Maintenance Costs**
  - **Reduced Spare Parts Costs: $9.54M over 3 Years**



VCU Innovations

- **GPC *and* PCB Functions Integrated Into one Box.**
- **True Microprocessor Control of all Functions Enables:**
  - **Precise Control of Power to Glow Plugs**
- **All PCB Relays Eliminated - Replaced by Ultra-High-Current Power MOSFETs.**
- **Multi-Channel Glow Plug Operation Enables:**
  - **Starting with Multiple Glow Plug Failures (Previously Impossible with old PCB System).**
  - **Simplified Glow Plug Troubleshooting/Diagnostics.**

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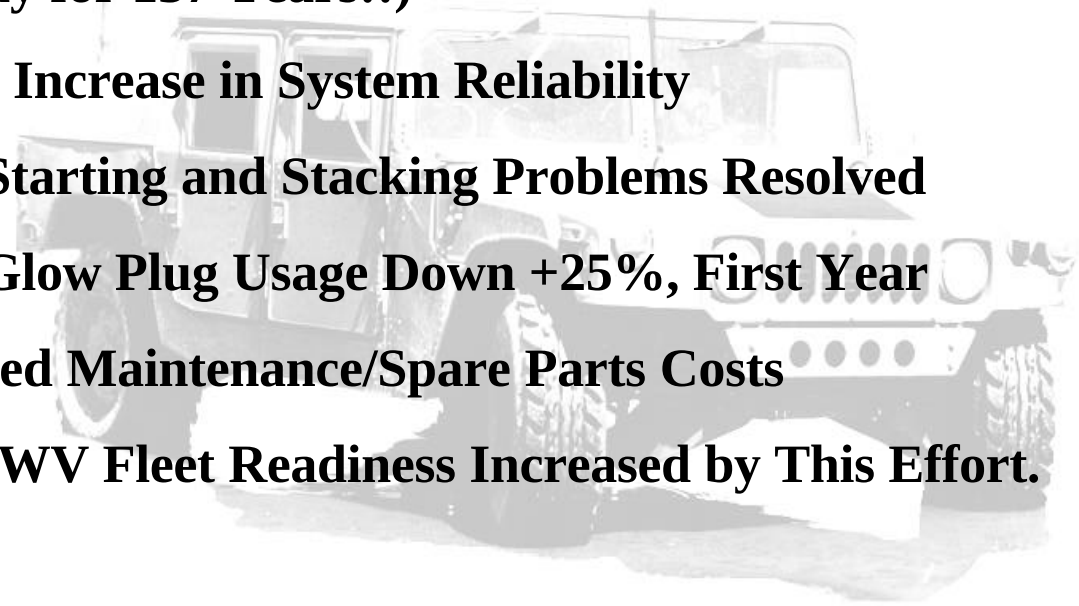
VCU - Interior View

VCU Results

- **Successful Completion of 200,000+ Test Starts. (Roughly 4 Starts per Day for 137 Years!!)**
- **Major Increase in System Reliability**
- **Cold-Starting and Stacking Problems Resolved**
- **Fleet Glow Plug Usage Down +25%, First Year**
- **Reduced Maintenance/Spare Parts Costs**
- **HMMWV Fleet Readiness Increased by This Effort.**

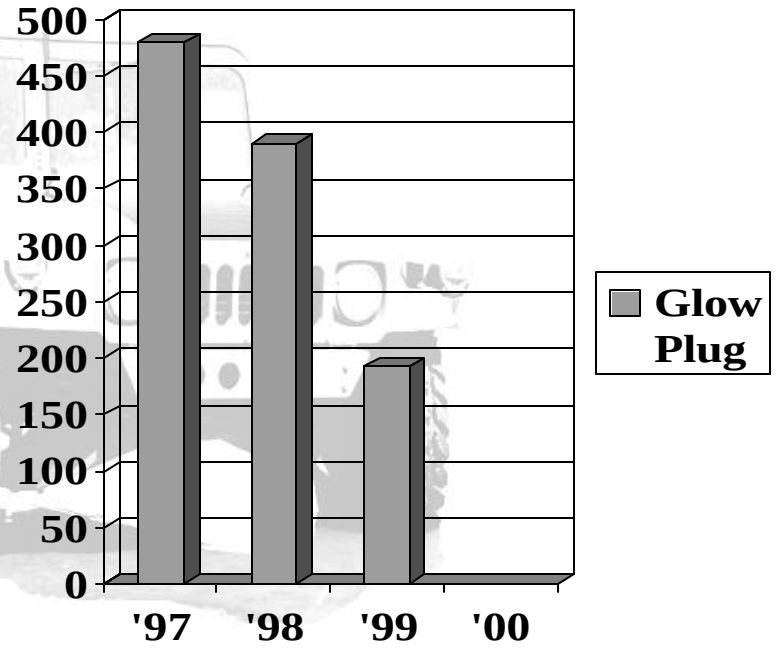


Ver. 14.0a VCU Improvements

- **Software and Hardware Upgrades From v.10 Unit:**
  - **Improve Performance and Reliability**
  - **Eliminate Self-Starting Problems Encountered in v.10 VCU**
- **Failure Rate (All Versions): 0.02% v. 28% for PCB**

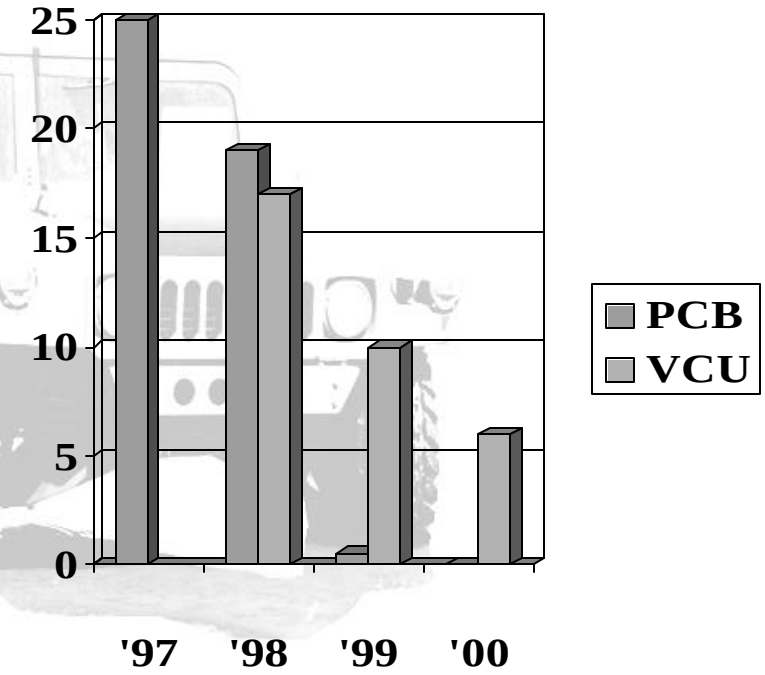
Glow Plug Usage (Thousands) 1997 – 2000

- **Usage in VCU-Equipped Vehicles Fell to Virtually Zero in Four Years**
- **$9.54 Million Spare Parts Savings over 3 Years**
- **Additional Savings of 50,000 hrs. Annual Maintenance**



PCB Usage (Thousands) 1997 – 2000

- **PCB Initial Usage Dropped +25% First Year**
- **VCU Usage Dropped +40% First Year**



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Program Results

- **NAC Embraces This as Initial Step Toward the Next-Generation of Vehicle-Electrical Architecture Implementation in HMMWV**
- **Leveraging COTS Technology for Innovative Solutions to Serious Readiness Issues**
- **$9.54 Million Spare Parts Savings From 1997 to 2000**